electricity employed for lighting purposes. The electrical works of the school are very remarkable. They include two engines, each of forty horse-power, which were presented by the makers. These work an Edison dynamo of 200 lamps, and three Gramme machines. The latter are each used alternately, and work six ventilators, which act over the whole building. Next to the electrical machines are two pumps which pump up water from a well; the school is also supplied with town water. Near the boilers is an Egrot alembic for distilling water for use in the laboratories. The steam from the water is conveyed by pipes into the laboratories, where it is employed in heating the water for washing, the stores, &c. In the basement are the cellars, store-rooms for glass, rooms for the study of stereotomy, for the construction of models, for stone-cutting, &c. The ground-floor includes a large court-yard, in the centre of which has been left the old fountain of St. Martin's Square. To the right of the entrance from the Rue Montgolfier is a staircase leading to a large vestibule, where the busts of the founders are placed. On this floor are the Mineralogical Museum, the dining-room of the Inspectors, stationery room, and the laboratory of industrial physics, the restaurants, the laboratory of industrial chemistry, and other special first year's laboratories, all opening on the court, the students working in the open air when dealing with noxious gases. The offices of the administrative body are on the first floor, and include director's and secretary's rooms, committee-rooms, steward's offices, and the like. These are lighted both by gas and electric light. The remaining rooms on the floor are devoted to students in their first year. Each storey has its large amphitheatre, capable of holding 250 students. These are formed at angles of the building, and are lit both by gas and electricity. The large blackboards behind the professors are raised and lowered by hydraulic machinery. The halls of study are ranged in two rows on one side of the building, with a corridor or passage between the rows for purpose of superintendence. Twelve pupils can occupy each room, and there are twenty-two rooms on each floor. The second and third stories are arranged on the same principle, except that on the former are the library and cabinets of collections. The fourth storey contains the large laboratories of the second and third year. The laboratory of the third year, of which an illustration is given, is the most important one in the school. Its appliances are of the most convenient and useful kind. Each student has all that he wants for his experiments at his hand.

NOTES

H.R.H. THE PRINCE OF WALES laid the first stone of the Museum of Science and Art and the National Library of Ireland on the 10th inst.

MR. RAPHAEL MELDOLA has been appointed Professor of Chemistry in the Finsbury Technical College in succession to Dr. H. E. Armstrong, who holds the Professorship at the Central Institute.

A SPECIAL general meeting of the London section of the National Association of Science and Art Teachers will be held at the Technical College, Cowper Street, Finsbury, on Saturday next, the 25th inst., at 7.30 p.m., when Sir H. E. Roscoe, V.P.R.S., President of the Association, will deliver an address on its objects. All interested in the teaching of science and art are cordially invited to attend. The above association was started in Manchester about three years ago for the purpose of advancing the teaching of science and art and improving the position of teachers. It already has strong sections in Manchester, Liverpool, Birmingham, Newcastle, and other large towns in the north, and the London section was started last year.

MCGILL COLLEGE, Montreal, has received, since September last, two donations from the Hon. Donald A. Smith, amounting in the whole to 24,000*l.* sterling (120,000 dollars), for the establishment of separate Lectures for Women, preparatory for the ordinary B.A. or an equivalent degree.

THE project for making Paris a seaport was brought before the Congress of Learned Societies on the 11th inst in a paper by M. Bouquet de la Grye. He said the subject was of importance from two points of view. The first and most important was the military one. The defence of Paris demanded imperatively the establishment of a port which would assure the victualling of the capital and its suburbs at all times. The commercial and industrial importance of the project is evident. The port should be established in the Poissy basin, and the Seine should be dredged to a mean depth of 6½ metres. M. de la Grye's system requires neither dams nor locks, but only the deepening of the bed of the river by dredging. It could be executed in four or five years. The total expense would be about 100 millions of francs.

DR. ROWELL, of Singapore, is stated to have made a valuable icthyological addition to the Raffles Museum there in the shape of a very complete collection of the fish and crustacea inhabiting the seas and rivers of the Malay Peninsula. Dr. Rowell, it is said, intends making a second similar collection to send to the Italian and Colonial Exhibition next year.

THE *Bulletin* of the Essex Institute (U.S.) contains a paper on American archæology, by Mr. F. W. Putnam, in which he refers to chipped stone implements. Referring to the statement often made that the making of arrowheads and similar objects is one of the lost arts, he says, that at the present time there are Indians in America who continue to manufacture them, and even work pieces of glass bottles into symmetrical and delicate arrowpoints. The method appears to be as follows:—A piece of stone is selected and roughly shaped by striking blows with a hammer-stone. If it is found to chip readily, it is shaped still further by light blows along the edges, each blow striking off a chip. Partly wrapped in a piece of skin, it is then held in the left hand and finished by flaking off little bits. This delicate part of the work is done with a flaking tool made usually of a piece of bone or antler. This is a few inches long, and about half an inch wide, having one end rubbed down to a blunt edge, which may be either straight, pointed, or notched. The other end is fastened to a piece of wood, so as to give a firm support to the hand. Sometimes this wooden handle is long enough to be held under the arm, thus steadying the implement which is grasped by the right hand. The edge of the flaker is pressed firmly against the edge of the stone, then with a slight rotation of the wrist a small flake is thrown from the edge of the stone. With a little practice this flaking can be done with considerable rapidity and precision. Some stones flake better after being heated. The various forms of chipped implements known as scrapers, drills, knives, spearpoints, and arrowheads probably were made by the method here described.

ACCORDING to the *Colonies and India*, Baron F. von Müller, K.C.M.G., has issued, under the auspices of the Victorian Government, a second supplement to his systematic census of Australian plants. It appears from the information now published that, whilst the known plants of Australia and Tasmania are about 9000, they occur in the following proportions in the respective colonies—viz. Western Australia, 3455; Queensland, 3457; New South Wales, 3154; Northern Australia, 1829; Victoria, 1820; South Australia, 1816; and Tasmania, 1023. The progress of botanical discovery in Australia within the last quarter of a century has been very marked, and the colonies are mainly indebted to Baron Müller for this result. In the beginning of the century (1805) Robert Brown, who may be called the father of Australian botany, returned to England with between 3000 and 4000 species of plants, and these in subsequent years he described in his "Prodromus Flora Novæ Hollandiæ et Insula Van Diemen." From the days of Brown no systematic work was added to his labours, until Baron Müller, considering that the time had arrived for the publication of a general Flora of Australia, joined with the late Mr. Bentham in preparing and publishing the seven volumes of the "Flora Australiensis."

THE Lords of the Committee of the Council of Education have given their consent for a certain portion of the Buckland Museum Collection to be exhibited in the aquarium during the forthcoming International Inventions Exhibition. The selection will include casts of various species of fish, models of vessels, appliances for catching fish, and apparatus for marine and freshwater fish-culture. Such a combination of exhibits will prove a considerable source of attraction, and tend to popularise the aquarium still further in the eyes of visitors to the Exhibition. To no better purpose could the exceedingly interesting collection in the Buckland Museum be utilised, hidden, as it has hitherto been, from general observation by its remote situation at South Kensington.

THE National Fish Culture Fishery at Delaford is now partially in working order, and a large number of fry have lately been placed in the ponds, where they are thriving exceedingly well. This is the only *national* establishment in the United Kingdom constituted for the purpose of acclimatising and culturing fish for the benefit of all communities, including all species of Salmonidæ and coarse fish.

THE Zoological Society has been presented by the National Fish Culture Association with a young seal which has hitherto inhabited one of the ponds in the Exhibition grounds, South Kensington. It was captured off the coast of Donegal, Ireland, whilst in a state of somnolence.

THE current number (No. 17) of *Die Natur* contains an article by Herr Emmerig, of Lauingen, on German bees as storm warners. From numerous observations, the writer advances tentatively the theory that on the approach of thunderstorms, bees, otherwise gentle and harmless, become excited and exceedingly irritable, and will at once attack any one, even their usual attendant, approaching their hives. A succession of instances are given in which the barometer and hygrometer foretold a storm, the bees remaining quiet, and no storm occurred; or the instruments gave no intimation of a storm, but the bees for hours before were irritable, and the storm came. He concludes therefore that the conduct of bees is a reliable indication whether a storm is impending over a certain district or not, and that, whatever the appearances, if bees are still, one need not fear a storm. With regard to rain merely, the barometer and hygrometer are safer guides than bees; not so, however, in the case of a thunderstorm. Finally, the writer trusts that his remarks on this subject may lead to further observation.

MESSRS. SAMPSON LOW AND CO. announce that during the present month they will publish "Under the Rays of the Aurora Borealis, in the Land of the Lapps and Kvæns," an original work, by Dr. Sophus Tromholt, edited by Mr. Carl Siewers. Besides a narrative of journeys in Lapland, Finland, and Russia during 1882–83, and descriptions of the interesting Lapps and Kvæns, the book will contain an account of the labours of the recent circumpolar scientific expeditions and a complete popular scientific exposition of our present knowledge of the remarkable phenomenon known as the aurora borealis or northern lights, to the study of which the author has devoted the greater part of his life. The work will also contain a map, chromo-lithographs, and 150 views, portraits, diagrams, &c., from photographs and drawings by the author, including numerous illustrations of the aurora borealis. Arrangements have been made for the publication of the work in France, Germany, Norway, Sweden, and Denmark.

MISS E. A. ORMEROD'S "Report of Observations of Injurious Insects and Common Farm Pests during the Year 1884, with Methods of Prevention and Remedy," has reached us. This issue is the eighth annual report that has been prepared by the author, and is much more bulky than any of its predecessors, extending to 122 pages. It embodies the remarks of numerous observers in various parts of the United Kingdom on the occurrence of insects injurious to farm and garden crops, the extent of their depredations, to which is often added suggestions for prevention and remedy. In glancing through the pages of this report it is not a little remarkable to notice how observant often of minute and interesting details Miss Ormerod's correspondents are, and, though many of them probably have little or no scientific training, their aptitude for observing the habits and effects of certain insects makes their records of considerable value. Setting aside the value accruing from the publication of the report under notice, Miss Ormerod has done a good work in inculcating such habits of observation amongst farmers and gardeners, who have opportunities such as few others have for noticing facts connected with the life-histories of such insects as destroy their crops. The plan of Miss Ormerod's report is alphabetical, arranged according to the name of the plant attacked—such, for instance, as the apple, beans, birds (with especial reference to the depredations of sparrows), cabbage, carrot, &c. Into the matter of the sparrows Miss Ormerod goes at considerable length. She says: "The subject of the great loss caused by sparrows still needs to be brought forward. The injury continues to be widespread and serious, not only with regard to corn, but likewise in fruit-farming districts, and to garden crops; and, to encourage those who are suffering under it to bestir themselves actively in getting rid of the pest, it is desirable to draw attention to some points connected with it which deserve consideration—such as what the food of the sparrow is during the whole year besides the corn which we see it robbing us of; what its habits are; and likewise whether, where sparrows have been destroyed during a series of years in any given area, that area has been infested *with more insects* or *with more of any special kind of insect*, than when the sparrows were there." Miss Ormerod's numerous correspondents all agree that sparrows will not feed on insects when seeds, grain, fruit, and other vegetable food is within reach, and that, consequently, their numbers must be kept down if any farm or garden crops are to be harvested. Miss Ormerod is careful to point out that in advocating a judicious destruction of the house-sparrow, other small birds are not included. With regard to the appearance of starlings in large numbers in insect-infested pea-fields, a correspondent at Kingsnorth, Kent, observed that the weevil began to commit serious damage, and although the peas grew away from this attack, Aphis followed, and "starlings by hundreds frequented the pea-fields, as also did numerous kinds of smaller insectivorous birds, *but not the sparrows, until the pea was large enough for him to peck it out of the pod.*" Amongst other subjects more fully treated of in the Report, are the hop aphis and damson hop aphis, the willow beetle, and some special observations on the warble fly, or ox box fly. The report will prove of much value to farmers, gardeners, and those interested in vegetable growth, and is full of interesting facts of scientific value. It is published by Messrs. Simpkin, Marshall, and Co.

AT a meeting of the Asiatic Society of Japan held in Tokio on February 11, Mr. Eastlake read a paper on the Japanese poisonous snake, *Trigonocephalus blomhoffi*, called by the natives *Mamushi*. It ranges in length from a little over one foot to nearly or quite two feet; the body is short and thick, the head triangular, half of it being covered by shields; the colour is earthy brown, with dark brown circular markings or spots; the belly is black, but the edges of the abdominal plates are whitish. The same snake has been observed in Japan, Formosa, Mongolia, Chihli, Sze-chuan, and Kiang-hsi. It is much dreaded by the Chinese, who give it several fanciful names; but its correct name is compounded of two ideographs meaning "worm" and "to strike," from the idea that it invariably inflicts two wounds. It derives one of its names ("only a day") from the notion that a person bitten by it lives only twenty-four hours. According to Kæmpfer, soldiers are fond of the flesh, and to this day it is highly esteemed as a febrifuge, and takes an important position in the Japanese pharmacopœia. The skin also is preserved as a talisman of singular efficacy. The popular belief is that the *mamushi* gives birth to its young through the mouth, but it is really oviviparous. It is said by one native encyclopædia that if the flesh be thrown on the ground the earth in the vicinity begins to hiss and steam, that the fat eats holes into everything it touches, that it is covered with bristles like a pig, is seven or eight feet long, carries a sting in its tail, and finally, that it should be eaten with "plum vinegar," or the leaves of the water-pepper. Taken thus, it cures irregular circulation of the blood and stubborn ulcers. The bite is seldom fatal, but when it is so, death occurs from circulation in the pulmonary arteries, producing asphyxia. As is the case with all *Crotalidæ* bites—for the *mamushi* is allied to the American rattlesnake, though far less venomous—the young can inflict poisonous wounds immediately after birth. The poison canal runs directly through the fang, while with many other snakes it simply lies in the groove of the fang. This tooth, or fang, may be compared with the needle of a hypodermic syringe; under the microscope it is flat, elliptic, sharp-pointed, and curved inward. In treating the wound, external applications are useless. In eating, the *mamushi* does not make use of its poison fangs, refusing even to eat anything that is killed with its venom. It is a reptile of nocturnal habits.

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus* ♂ ♀) from India, presented by Mr. A. J. McEwens, a Campbell's Monkey (*Cercopithecus campbelli* ♀) from West Africa, presented by Miss Lyster; a Wild Boar (*Sus scrofa* ♀), European, presented by the Rev. Horace Waller; an Emu (*Dromæus novæ-hollandiæ*) from Australia, presented by Capt. J. E. Erskine, R.N.; two Gouldian Grass Finches (*Poephila gouldiæ*) from Australia, presented by Mr. Chas. N. Rosenfeld, two Turtle Doves (*Turtur communis*), British, presented by Miss Reinhold; a Common Badger (*Meles taxus*), British, a Toco Toucan (*Ramphastos toco*), two Guira Cuckoos (*Guira piririgua*), a Brazilian Caracara (*Polyborus brasiliensis*) from Brazil, a Short-tailed Albatross (*Diomedea brachyura*) from Antarctic Seas, four Pintails (*Dafila acuta* ♂ ♂ ♀ ♀), European, four Summer Ducks (*Œx sponsa* ♂ ♂ ♀ ♀) from North America, two Spotted-billed Ducks (*Anas pœcilorhyncha* ♂ ♀) from India, deposited; two Summer Ducks (*Œx sponsa* ♂ ♀) from North America, four Mandarin Ducks (*Œx galericulata* ♂ ♂ ♀ ♀) from China, a Swinhoe's Pheasant (*Euplocamus swinhoii* ♂) from Formosa, a Common Spoonbill (*Platalea leucorodia*), European, purchased; three Black Swans (*Cygnus atratus*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

HALLEY'S COMET IN 1456.—"This comet cannot exhibit a greater degree of brightness than when it passes the perihelion in the month of June; it may then be observed some days before perihelion; it is visible at perihelion itself, and, when it has passed that point, it continues to approach the earth, and its brightness consequently increases for some days." In these terms Pingré introduces his account of the appearance of Halley's comet in 1456, when, from the vague notices in the European chronicles which were available to him, he fixed the perihelion passage on June 8 at 22h. 10m. Paris mean time. The comet was observed in China on the morning of May 27.

A recent discovery of contemporary documents has led to our being put in possession of a much closer approximation to the elements of the orbit of Halley's comet at this return than it was possible to deduce from the published records of European historians and the Chinese description of its track given by Edouard Biot in the *Connaissance des Temps* for 1846. Prof. Uzielli a few years since found in the National Library at Florence a manuscript of Paolo dal Pozzo Toscanelli, with a chart upon which the positions of the comet and neighbouring stars are shown between June 8 and July 8, of which he forwarded a *fac-simile* to Prof. Celoria of the Royal Observatory at Milan, who has utilised it for the determination of the comet's orbit. There are in all, positions on twenty-four days. Prof. Celoria first compared the places of twenty-one stars read off from the chart, with their places reduced from modern positions to 1456·5, and found a mean correction of + 26′ to Toscanelli's longitudes and + 24′ to his latitudes—a rather surprising agreement for that epoch. Whether Toscanelli obtained his places from the catalogue of the Almagest, from that of Ulug Beigh, or some Arabian catalogue that had reached him, does not appear. The corrections named were applied to Toscanelli's positions of the comet, and, assuming the semi-axis major to have been 17·9676 (this value corresponding to the mean period between 1378 and 1835), Celoria obtains a first set of elements, which are used in the formation of normal places and differential equations, the solution of which leads him to the following most probable elements of the comet's orbit, depending on Toscanelli's observations:—

Perihelion passage 1456, June 8·20875, Paris M.T.

	°	′	″	
Longitude of perihelion … …	298	56	47	Equinox of 1456·5
,, ascending node …	43	46	4	
Inclination … … … … …	17	37	27	
Log. excentricity … … … …	9·98580			
Log. perihelion distance … …	9·76363			

Motion—retrograde.

On May 26·266 Paris M.T., about which time the comet was detected in China, the above elements give its position in R.A. 35° 43′, Decl. + 23° 53′, distance from the earth 1·140, and from the sun 0·646. On June 17·333, in R.A. 106°·5, Decl. + 40°·7, it was at its least distance from the earth (0·446), and having then passed the perihelion about nine days, it was doubtless near this time that the comet created so much alarm by its brilliancy and magnitude. On July 8·339, when it was last observed by Toscanelli, its position was in R.A. 166° 34′, Decl. + 7°·0′, distance from the earth, 1·051, and from the sun 0·865.

The latest translation of the Chinese description of the track of the comet will be found in Williams's well-known volume, p. 77.

In addition to the observations of Halley's comet, Toscanelli's manuscripts supply observations of the comets of 1433, 1449, 1457 (I. and II.), and 1472, and Prof. Celoria has published elements deduced therefrom of all, except that of 1472, in the *Astronomische Nachrichten*. It appears beyond question, to use Prof. Celoria's own words, "Che le osservazioni in esso contenute sono assai preziose, danno a Toscanelli il vanto di avere prima d'ogni altro fatte intorno alle comete osservazioni propriamente dette, e rivelano in lui un osservatore abile non che una conoscenza sicura ed intera del cielo."

Irving represents Toscanelli as the correspondent and adviser of Columbus. Montucla's account of him chiefly relates to his erection of the gnomon in the Church of S. Maria del Fiore, at Florence, of which Ximenes published an account in 1757, wherein Montucla thought he claimed for Toscanelli more than was his due. As, however, Prof. Uzielli is engaged on researches respecting him, we may soon be more fully informed as to the works of one who certainly claims an honourable place in the history of observational astronomy.

THE TOTAL SOLAR ECLIPSE ON SEPTEMBER 9.—It may be remembered that during totality in the eclipse of December 22, 1870, the planet Saturn was situate within the coronal limits, but we are not sure that it was anywhere distinctly remarked. At the time of totality in the eclipse of September next in New